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## Multiple births in the northern fur seal

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This paper describes three twin births in the northern fur seal (*Callorhinus ursinus*), and subsequent behavior of mothers and young. To our knowledge, these are the first descriptions of multiple births among the Pinnipedia. They illustrate several adaptations to amphibious existence.

Northern fur seals live at sea, rarely touching land until summer, when they assemble on islands for parturition, copulation, and nurture of young to weaning age. The reproductive cycle includes a single post-partum estrus and delayed implantation, permitting a gestation period of almost exactly one year. Females leave their young within a few days after birth, returning in ten days (mean interval length) to nurse their pups for two days; this cycle is repeated continuously for four months following parturition. Individual recognition ability and highly concentrated milk permit females to feed at sea extended intervals, yet successfully rear their offspring on shore.

Fur seals, as well as other pinnipeds, generally give birth to single young each year. BERTRAM (1940) has suggested that uniparity in seals is advantageous, since parental care is highly demanding and mother-young mutual behavior is very specific. To the present time, however, statistics concerning the incidence of twinning in pinnipeds, or success of parturition and rearing of twins, have very seldom been reported. Twin fetuses have been mentioned as "rare" (see HARRISON et al. 1952, p. 442, and SLIPJER 1956, p. 42). In several genera, two young have been seen suckling one female; more accurate information has been lacking.

## Methods

Approximately 50 male and 800 female fur seals were observed from a blind during three summers at Kitovi Rookery, St. Paul Island, Alaska, for study of social and reproductive behavior (R. S. P.). In 1961, the initial year, most of the animals were marked with large, individual, semi-permanent symbols bleached in the pelage. One of the 640 marked females gave birth to twins (Case I) as did an unmarked female at the same rookery (Case II). For close observation and recording of female-young vocalization at birth (W. G. R.), three pregnant females were captured and penned during July, 1962. One of these delivered twins (Case III).

A roentgenogram of the uterus of the post-partum female in Case III was made after the animal was tranquilized with propiopromazine (2.0 mg/kg), and strapped to

a table. A cannula was passed through a medical sigmoidoscope in the vagina, and dilute aqueous iodide (manufactured for contrast radiography) deposited beyond the undilated cervix just prior to x-ray exposures. The female was released later, apparently unharmed.

### Frequency of multiple fetuses

Northern fur seal twins were mentioned by VENIAMINOF (1839), though the first conclusive record was only recently published (NIGGOL and FISCUS 1960). During five years of pelagic research by the United States Fish and Wildlife Service, 4223 pregnant females were collected in the eastern Pacific Ocean and Bering Sea. Six of these females carried twins (FISCUS et al. 1964, p. 34). From the observed incidence (0.14 per cent), duplex implantation appears rare; successful delivery of two living young may be even rarer.

### Observations

*Case I:* On 25 June 1962, a marked female ("red x") delivered a single pup on Kitovi Rookery at 6:30 AM. She was known to have failed to raise a pup in 1961. The newborn, designated I-A, behaved normally, beginning mutual vocalization with its mother soon after delivery. The first irregularity in the process was noted ten minutes after the placenta had been delivered, when the female assumed a birth posture and again appeared to be in labor. The first pup was soon neglected, as its mother moved in a roughly circular pattern, dragging her hind quarters. At 7:00 AM, a second pup was born.

Vocalization between the mother and second pup (I-B) began, but at this point the first pup returned, evidently attracted by the sound. Pup I-A, 30 minutes older and slightly larger than its sib, was able to vocalize more vigorously. When the mother moved slightly in responding to I-A, the smaller I-B fell down an incline, dragging its placenta. The mother did not respond further to its feeble calling, nor did she attempt to retrieve it. Thus, the second pup was separated from its mother soon after birth, anchored a short distance away by its placenta, which had become caught in a crevice.

The pups (two males) were tagged 24 hours after birth, and I-B was freed when its placenta was taken for examination. This pup began wandering among females and was rejected by each one it approached, including its mother (Figure 1). Little or no preference for its own mother was evident in the behavior of this pup. It wandered for two weeks, becoming very emaciated. Apparently it had never nursed when it finally disappeared from the rookery on the 16th day after birth.

The mother continued to suckle I-A in the usual manner. She came into estrus on 30 June, copulation ensued, and she departed for sea the following day. She returned on 7 July, searched for and located I-A, and nursed for two days. Similar cycles followed until 31 October 1962, when the pup apparently was weaned. In 1963, this female was not observed.

*Case II:* Another twin birth was observed on the same rookery, but the female had not been marked and could not be identified with certainty for long after the delivery. The two pups were born on 10 July 1962, at 3:30 and 3:40 PM; the mother was never observed nursing both. It appeared that one of the pups was rejected shortly after birth.

*Case III:* On 15 July 1962, a pregnant female was captured on Northeast Point Rookery, and temporarily confined in a slat cage. On the following day about 4:30 PM, the first pup (III-A) was born. Delivery appeared normal. Mutual vocalization began within the first minute and continued for a little over 20 minutes,

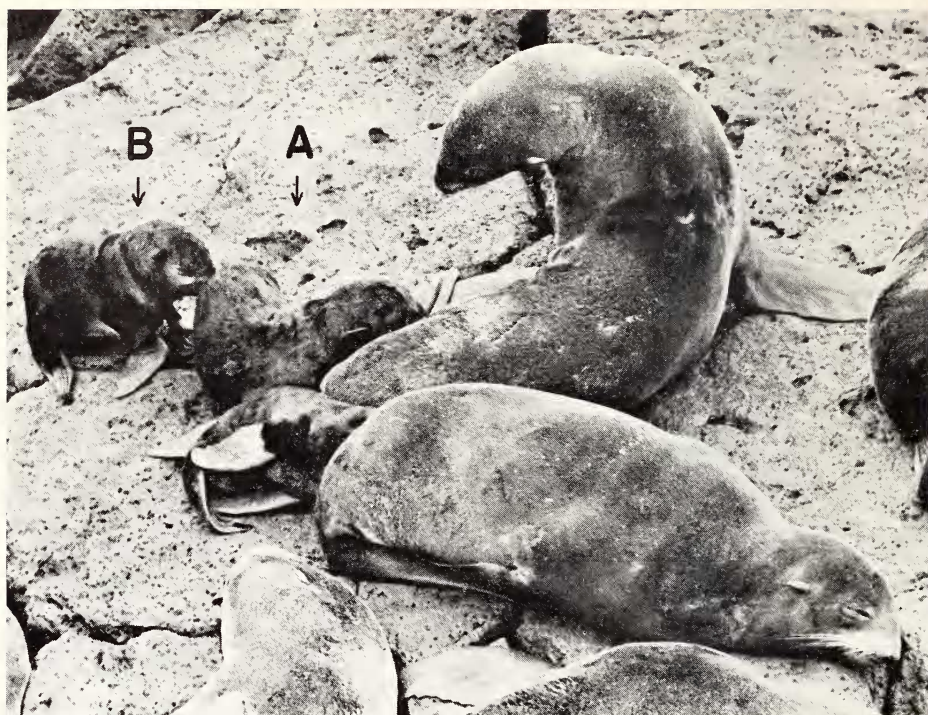


Fig. 1. Female fur seal and twin pups described as Case I. The pup (I—A) nursing in this photograph was reared normally. The other (I—B), left, never developed mutual recognition with its mother and eventually died.

though the rate of calling by the mother declined strongly after the first 12 minutes, when she seemed to be experiencing pain. The placenta had not been delivered.

Approximately 25 minutes after the birth of the first pup, the second (III-B) appeared, followed shortly by a single placental mass. Pup III-B began calling shortly after birth, but elicited minimal response from its mother, which was very quiet and moved little for nearly an hour. Her occasional vocalization evoked responses from both pups. The pups vocalized almost continually, calling and responding to each other, in a pattern and frequency similar to that noted in mother-young mutual calling after a normal single birth. Since the mother failed to vocalize consistently in response to the pups, it seems unlikely that recognition of the female's individual call could have developed in either pup.

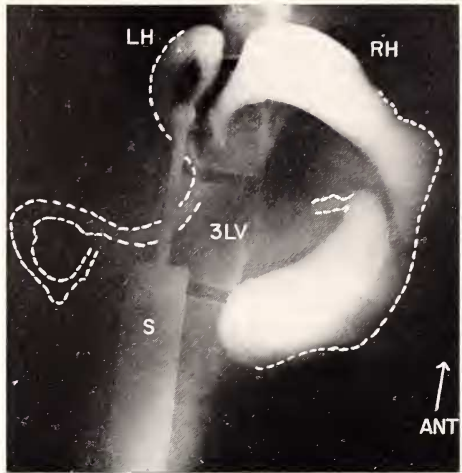
At one day of age, the two pups (females) were weighed ( $A = 5.8$  kg;  $B = 5.3$  kg). The mother was allowing both to suckle. III-A was clearly stronger and more active, and its knowledge of the mammary position soon became quite accurate. III-B, however, fed for fewer and shorter periods and never developed accuracy in its location of the nipples, often requiring appreciable periods of hunting prior to suckling.

Confinement of this female undoubtedly affected her behavior in accepting both pups. EUGENE T. LYONS (personal communication) found that captive female fur seals could be induced to accept pups other than their own. This was never observed on Kitovi Rookery, where more than 200 mother-young pairs were marked and carefully observed.

The placenta, originally a single mass, broke apart shortly after the birth of III-B,



Fig. 2. Roentgenogram of iodide-filled uterus of female fur seal in Case III. Five days postpartum. Dorsal view. LH Left Horn of uterus, RH Right Horn of uterus, 3LV 3rd Lumbar Vertebra, S Sigmoidoscope with cannula protruding at top, ANT Anterior direction.



a section remaining tethered to each pup. This connection suggests unilateral implantation. Five days after parturition, a roentgenogram was made of the uterus (Figure 2), demonstrating enlargement of only the right uterine horn.

After the x-ray was taken, the mother and two pups were released on Kitovi Rookery and kept under observation. The mother came into estrus and accepted copulation; the pups remained near her through this period. Two days after release, the mother departed to sea and was not later observed, perhaps due to her release on a rookery otherwise strange to her. The two pups wandered separately and extensively, and one was observed twice near the former inland location of the cage in which it had been born, above the rookery. Five days after the departure of the mother, both pups (now aged ten days) left the rookery for the final time. One was not seen again; the second was found three days later about  $\frac{3}{4}$  mile (1.2 km) inland on a truck road. It died shortly thereafter in captivity.

### Discussion

There are physiological and social disadvantages to multiple young in pinnipeds. Among the Phocidae, prodigious growth of the newborn pup requires a very large quantity of milk, such that "one doubts [a female's] ability to provide in this way for two pups simultaneously" (BERTRAM 1940, p. 27). Young fur seals (Otariidae) grow more slowly, but must store enough nourishment at each nursing to survive and grow through regular fasts while their mothers are feeding at sea. Although marine mammals have the most concentrated milk of any yet tested, (see KOOYMAN 1963) we are not sure that any seal could supply sufficient milk to raise two pups to weaning.

The process of locating one particular pup among thousands on a fur seal rookery is complex, and sometimes a mother searches for several hours before finding her own. The problem would be compounded if multiple young were involved. Further, if two young should be accepted, as has been suggested in Case III, perhaps mutual calling sequences would not develop adequately with either pup. Young respond to vocalization of the mother at birth, but evidently must learn individual recognition postnatally, especially during the first day. This was emphasized by the lack of recognition between the mother and the second pup in Case I.

Annual alternation of the implantation site between the two uterine horns is usual in fur seals. Thus, an embryo begins development in a resting horn. Perhaps twins could not develop bilaterally in a female which had been pregnant the preceding year, for only one horn would be resting. In Case I, the only individual whose history is known, no pup was born the year preceding the birth of twins; implan-

tation may have been bilateral since there were two placentae. Records for other twins show five unilateral, and three bilateral implantations (FISCUS et al., op. cit.).

The evidence that one pup is rejected by its mother if twins are born, and the extreme rarity of twin fetuses, support the idea that natural selection has favored uniparity in fur seals.

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### Summary

Three examples of twin births in the northern fur seal are described. In no case were two young raised to weaning age. The very low incidence of duplex implantation appears to be one of a remarkable series of adaptations permitting successful rearing of young.

### Zusammenfassung

Es werden drei Berichte über Zwillingsgeburten bei der nördlichen Pelzrobbe gegeben. In keinem Fall wurden zwei Junge bis zur Entwöhnung aufgezogen. Das sehr seltene Vorkommen von doppelter Implantation scheint eine der bemerkenswerten Anpassungen für erfolgreiche Aufzucht eines Jungen zu sein.

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